2019

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Addictive Behaviors 92 (2019) 128–135

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Youth perception of harm and addictiveness of tobacco products: Findings from the Population Assessment of Tobacco and Health Study (Wave 1)

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HIGHLIGHTS

- This study assessed youth harm and addictiveness perceptions of six tobacco products.
- Smokeless tobacco, pipe, hookah and e-cigarettes were perceived as less harmful than cigarettes.
- Understanding youth tobacco perceptions remains a focus of prevention efforts.

ARTICLE INFO

Keywords:
Tobacco harm perceptions
Tobacco addiction perception
Youth tobacco prevention

ABSTRACT

Purpose: We provide a US national assessment of youth perceptions of the harm and addictiveness of six separate tobacco products, identifying a continuum of perceived harm associated with a range of products in relation to patterns of current use, former use, and susceptibility to use tobacco products.
Methods: We evaluated youth respondents ($N = 13{,}651$) ages 12–17 from Wave 1 (2013–2014) of the Population Assessment of Tobacco and Health (PATH) Study. Analyses (2015–2016) focused on refining measures of perceived harm for each product and delineating youth characteristics (demographic, tobacco use status) associated with beliefs about the harmfulness and addictiveness of tobacco products.
Results: Cigars, hookah and e-cigarettes were each perceived as having significantly lower harm (p's < 0.05) than smokeless products, with the lowest ratings of harmfulness and addictiveness observed for hookah and e-cigarettes (p's < 0.001). Incrementally lower levels of harm and addictiveness perceptions were observed among youth at increasing risk for tobacco use (p's < 0.05).
Conclusions: Among U.S. youth, lower perceptions of harm and addictiveness of tobacco products were associated with susceptibility to use tobacco and patterns of tobacco product use. Future longitudinal assessments from the PATH Study can provide key information on youth development of perceptions of harm and addictiveness and influences on patterns of tobacco use.

1. Introduction

Adolescents' perceptions of harm and addictiveness of tobacco products may influence their susceptibility to try a specific tobacco product, as well as develop future tobacco use behaviors (Pepper, Ribisl, & Brewer, 2016; Song, Morrell, Cornell, et al., 2009). Early tobacco use among youth has implications for the development of addiction (U.S. Department of Health and Human Services, 2014), long-

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https://doi.org/10.1016/j.addbeh.2018.12.005
Received 1 June 2018; Received in revised form 30 October 2018; Accepted 4 December 2018
Available online 03 January 2019
0306-4603/

term exposure to toxicants, and associated health consequences (Hatsukami, Biener, Leischow, et al., 2012). Tobacco companies have employed marketing strategies, such as product design and media advertising, to appeal to target audiences, including young adults, and communicate the impression of their product as less harmful (U.S. Department of Health and Human Services, 2012; Wakefield, Morley, Horan, et al., 2002) While public health professionals have worked to counteract these efforts (Campaign for Tobacco-Free Kids, n.d.; Farrelly, Duke, Nonnemaker, et al., 2017; U.S. Department of Health and Human Services, 2012), there has been an emergence of non-combustible products and new advertising campaigns that could influence youth's perceptions of harm and addictiveness of these products (Grana, Benowitz, & Glantz, 2014).

Lower perceptions of harm have been previously associated with higher rates of use of many different tobacco products, including a) cigarettes (Halpern-Felsher, Biehl, Kropp, et al., 2004; Song et al., 2009), b) e-cigarettes (Pearson, Richardson, Niaura, et al., 2012), c) snus (Choi, Fabian, Mottey, et al., 2012), and d) hookah (Creamer, Loukas, Li, et al., 2016; Maziak, Eissenberg, & Ward, 2005). Recent school-based surveys (Chaffee, Gansky, Halpern-Felsher, et al., 2015; Cooper, Harrell, Pérez, et al., 2016; Roditis, Delucchi, Cash, et al., 2016) have assessed youth harm perceptions of tobacco products by asking respondents about the dangers of using a product given their age (Cooper et al., 2016), or asking about the social and physical harms of using a product daily (Chaffee et al., 2015; Roditis et al., 2016). These studies suggest that youth perceive products on a continuum of risk, with cigarettes, cigars and smokeless products ranked higher than hookah and e-cigarettes (Roditis et al., 2016). Importantly, rankings of harm perceptions and addictiveness of tobacco products differ significantly for current users and non-users of tobacco (Chaffee et al., 2015; Cooper et al., 2016). Rankings of harm and addictiveness may also depend upon patterns of product use (e.g., concurrent use of cigarettes), particularly when rankings reflect comparative perceptions of addictiveness for non-cigarette relative to cigarette products (Amrock, Lee, & Weitzman, 2016; Halpern-Felsher et al., 2004). For example, cigarette smokers were less likely than non-cigarette smokers to endorse e-cigarettes as less harmful than cigarettes but were not less likely than non-cigarette smokers to endorsed e-cigarettes as less addictive than cigarettes (Amrock et al., 2016). Recent examination of youth (Persoskie, O'Brien, Nguyen, et al., 2017) suggests that population surveillance assessing harm and addictiveness perceptions of specific tobacco products remains important in identifying groups susceptible to using tobacco.

The primary aim of this paper was to describe youth perceptions of harm and addictiveness of tobacco products across age, gender, and racial/ethnic groups and to understand patterns among non-users and users of tobacco, using data from the U.S. nationally representative Population Assessment of Tobacco and Health (PATH) Study. We also examined whether perceptions of harm from tobacco products varied among non-users classified by their increasing susceptibility to experimentation. We hypothesized that, compared to youth committed to not using a particular tobacco product, youth who were susceptible to using it, or who experimented with it, would perceive lower levels of harm and addictiveness of the product (including cigarettes, e-cigarettes, cigars, hookah, pipes, smokeless, and multiple tobacco products). Finally, we report how patterns of combustible, non-combustible, and poly-tobacco product use relate to perceptions of one's own and other products.

2. Methods

2.1. Data

The National Institutes of Health, through the National Institute on Drug Abuse, is partnering with the Food and Drug Administration's Center for Tobacco Products to conduct the PATH Study under a contract with Westat. The PATH Study is an ongoing, nationally-representative, longitudinal cohort study of adults and youth in the US. The PATH Study used audio-computer assisted self-interviews (ACASI) available in English and Spanish to collect self-report information on tobacco-use patterns and associated health behaviors. Wave 1 data collection was conducted from September 12, 2013 to December 14, 2014. This analysis draws from the 13,651 Youth Interviews and includes youth (12–17 years) who had heard of each product and responded to the harm perception and addictiveness questions (N = 13,620). The PATH Study recruitment employed a stratified address-based, area-probability sampling, at Wave 1 that oversampled adult tobacco users, young adults (18 to 24 years), and African American adults. An in-person screener was used at Wave 1 to select youths and adults. Population and replicate weights were created that adjusted for the complex study design characteristics (e.g. oversampling at Wave 1) and nonresponse at Wave 1. Combined with the use of a probability sample, the weights allow analyses of the PATH Study data to compute estimates that are robust and representative of the non-institutionalized, civilian US population ages 12 and older. At Wave 1, the weighted response rate for the household screener was 54.0%. Among households that were screened, the overall weighted response rate was 78.4% for the Youth Interview. Further details regarding the PATH Study design and methods including the location of the current study questions within the interview are published by Hyland and colleagues (Hyland, Ambrose, Conway, et al., 2017) and in the User Guide to the PATH Study restricted use files, available at http://www.icpsr.umich.edu/icpsrweb/NAHDAP/series/006061. The study was conducted by Westat and approved by Westat's institutional review board.

2.2. Study measures

Assessment domains for the current paper included perceptions of harm from each tobacco product, perceptions of the addictiveness of each tobacco product, susceptibility to use tobacco products, patterns of tobacco product use, and demographic characteristics. We created two primary independent indices to reflect a) levels of risk for tobacco use and b) patterns of tobacco use among users of tobacco products.

2.2.1. Tobacco products

Respondents were presented with images of non-cigarette products and asked if they had heard of or used each of the following tobacco products: cigarettes, e-cigarettes, cigars (including traditional cigars, cigarillo, and filtered cigars), pipes, hookah, smokeless tobacco, dissolvable products, bidis, and kreteks. Use of dissolvable products, bidis, and kreteks were not included in this report due to low frequencies of youth who had heard of or used these products.

2.2.2. Tobacco harm perceptions

Harm perceptions of cigarettes were assessed with a single item reflecting the absolute harm from using each product, which we refer to as the *global* harm perception item: “How much do you think people harm themselves when they [USE PRODUCT]?” (response options: ‘1 = No harm’, ‘2 = A little harm’,‘3 = Some harm’, ‘4 = A lot of harm’; collapsed to: ‘1 = No harm or little harm’, ‘2 = Some harm’, ‘3 = A lot of harm’). Harm perceptions for cigars, e-cigarettes, hookah, pipe, and smokeless tobacco were assessed using this same item plus two others assessing the perceived exposure needed to produce harm (“How long do you think someone has to [USE PRODUCT] before it harms their health?”; response options: ‘1 = 1 year or less than 1 year’, ‘2 = 5 or more years’, ‘3 = It will never harm their health’) and another item assessing perceived harm relative to cigarettes. (“Is [USING PRODUCT] less harmful, about the same, or more harmful than smoking cigarettes?”; response options: ‘1 = Less harmful’, ‘2 = About the same’, ‘3 = More harmful’). All “refused”, “don't know,” and missing responses

were treated as missing in analyses.[1] Given multiple cigar types, we examined each respondent's pattern of responses across questions that inquired about 'traditional', 'cigarillo', and 'filtered' cigars. If respondents had heard of 'cigars' but not the specific type of cigar, they responded to questions about 'traditional, cigarillo or filtered cigars'. In this case, we created a single value for each of the three harm perception questions using the highest rating for any cigar product question.

For cigars, e-cigarettes, hookah, pipe, and smokeless tobacco, we evaluated the appropriateness of combining the three harm perception items into a single composite index for each product type. We examined item inter-correlations to test for internal consistency, and we examined item option associations with summed totals and non-parametric item response curves to test for monotone increasing probability of higher options with higher summed scores (Ramsay, 1991) and to quantify the degree to which increasing item scores were related to increasing summed scores using scalability coefficients for sets of items addressing each product (Sijtsma, 2009). Scalability coefficients can be interpreted as the degree to which subjects can be ordered by mean item responses and thus measure the same construct (Sijtsma & Meijer, 2007; van Abswoude, van der Ark, & Sijtsma, 2004). Scalability coefficients range from 0 (i.e., no ordered relationship among item responses and summed levels of harm perceptions) to 1 (i.e., perfect ordering of item responses for people and summed levels of harm perceptions). Scalability coefficients were considered weak if < 0.40, moderate if between 0.41 and 0.50, and strong if > 0.50 (Sijtsma & Molenaar, 1987).

Only the items for pipes failed to provide evidence for at least moderate scalability (h = 0.32); for the other products, there was support for scalability and evidence of reliable measurement provided by internal consistency reliability coefficients (e-cigarettes: h = 0.62; alpha = 0.72; cigars: h = 0.46; alpha = 0.57; hookah: h = 0.46; alpha = 0.59; smokeless tobacco: h = 0.46; alpha = 0.57). Also, internal consistency estimates for the latter products suggested an acceptable tradeoff given the benefit of multi-item criterion measures, lack of reliability estimates if we had relied upon single items, and an estimated range of potential attenuation of relationships (square root of internal consistency estimate) from a maximum of (1.0 to 0.75–0.85 [39]t). Thus, harm perceptions for pipes and cigarettes were represented by the single, global item (see above), scaled to mirror the other product indices, whereas harm perceptions for cigars, e-cigarettes, hookah, and smokeless products were represented by the three item index.

2.2.3. Tobacco addiction perceptions

We assessed perceptions of the addictiveness of each product using the following question: "How likely is someone to become addicted to [PRODUCT]?" Response options were '1 = Very unlikely', '2 = Somewhat unlikely', '3 = Neither likely nor unlikely', '4 = Somewhat likely', and '5 = Very likely'. All "refused", "don't know," and missing responses were treated as missing in analyses.[2]

2.2.4. Tobacco use

Youth who reported that they had heard of a particular product were asked, "Have you ever tried [PRODUCT]?" (Yes/No). Youth who had ever tried the product were further asked, "When was the last time you [USED PRODUCT]…?" Current users were defined as those reporting use during the past 30 days, and ever/lifetime users were defined as those reporting no use during the past 30 days. Youth who had not ever tried a product were classified as never users of that particular product.

[1] Reports of "don't know" ranged from 0.9% - 2.5% for the first item, 1.7%–5.1% for the second item, and 4.8%–8.4% for the third item.

[2] Reports of "don't know" ranged from 1.5%–5.7%.

2.2.5. Susceptibility index

For youth who reported never using the corresponding tobacco product, we used a validated susceptibility index (Strong, Hartman, Nodora, et al., 2015) which included the following questions: 'Have you ever been curious about [USING PRODUCT]?'; 'Do you think you will [USE PRODUCT] in the next year?'; 'If one of your best friends were to offer you a [PRODUCT], would you [USE] it?' All never smokers received these questions about cigarettes. For e-cigarettes, cigars, pipes, hookah, and smokeless/snus, participants received these questions about each product if they were a never user of the product and had previously heard of the product. Each question had a 4-level response that ranged from "not at all curious" to "very curious," or from "definitely not" to "definitely yes." Youth who responded with 'not at all curious' or 'definitely not' to all three questions were classified as committed never users of that product, while all others were classified as susceptible (Strong et al., 2015). Respondents who "refused" or reported "don't know" were classified as missing.

2.2.6. Levels of risk for tobacco product use

For each product, levels of risk were assigned using mutually exclusive groupings of the Susceptibility Index and reports of tobacco use. We classified 'committed never user' at the lowest risk, followed by youth classified as 'susceptible', youth classified as 'ever/lifetime users', and youth classified as having 'used in the past 30 days'.

2.2.7. Index of tobacco use groups

Youth who reported no lifetime use of any tobacco products were classified as 'non-users.' Other youth were classified by their lifetime tobacco use/experimentation as 'cigarette only', 'non-cigarette combustible products only' (i.e., only cigar, pipe, hookah, or multiple non-cigarette combustible product use), 'e-cigarette only', 'other non-combustible products only' (i.e., only smokeless, snus, or multiple non-combustible product use), or 'poly-tobacco cigarette users' (i.e., both cigarette and non-cigarette products).

2.2.8. Demographics

We categorized respondents into age groups of 12–13, 14–15, and 16–17, consistent with other national surveys. Questions assessing gender and race/ethnicity were administered. Missing data on age, gender, race, and Hispanic ethnicity were imputed as described in the PATH Restricted Use File User Guide (United States Department of Health and Human Services, n.d.).

2.3. Statistical analysis overview

All estimates are weighted for the PATH study's complex sample design using replicate weights and the Balanced Repeated Replication (BRR) method with Fay adjustment (e.g. Fay = 0.3) computed with the "survey" package (Lumley, 2015) and R statistical software (Team, 2016). Individual hypotheses were tested using separate multivariable regression models assessing harm perceptions and addictiveness perceptions. Models incorporated a standard set of demographic covariates (age, gender, race/ethnicity).

3. Results

3.1. Sample characteristics

Analyses were limited to youth who had heard of each product and responded to questions about harm perceptions, addictiveness, product use, and susceptibility. Youth who had heard of each product were classified into the following user groups and described using observed sample sizes and weighted percentages: never having tried tobacco products (n = 10,751, 80.0%), cigarette only users (n = 461, 3.3%), non-cigarette combustible product only users (cigar, pipe, or hookah;

Table 1
Demographic associations with perceived harmfulness and addictiveness of tobacco products.

	Cigarette[a]				E-Cigarette				Cigar			
	n	mean	se	p	n	mean	se	p	n	mean	se	p
Harm perception	13,620	2.79	0.01		10,804	1.95	0.01		7838	2.47	0.01	
Age												
12–13	4669	2.83	0.01	0.000	3352	2.01	0.01	0.000	2024	2.53	0.01	0.000
14–15	6845	2.78	0.01		5670	1.92	0.01		4272	2.46	0.01	
16–17	2106	2.75	0.01		1782	1.93	0.01		1542	2.44	0.01	
Gender												
Male	6978	2.78	0.01	0.000	5512	1.89	0.01	0.000	3985	2.47	0.01	0.947
Female	6642	2.81	0.01		5292	2.01	0.01		3853	2.47	0.01	
Race/ethnicity												
Non-hispanic white	6607	2.80	0.01	0.129	5414	1.96	0.01	0.000	3964	2.48	0.01	0.000
Hispanic	3908	2.78	0.01		2978	1.97	0.01		1978	2.49	0.01	
Black	1856	2.78	0.01		1435	1.86	0.01		1192	2.41	0.02	
Other non-hispanic	1249	2.81	0.01		977	1.99	0.02		704	2.51	0.02	
Addictiveness perception	13,420	4.09	0.01		11,456	3.6	0.01		8304	3.99	0.02	
Age												
12–13	4542	4.03	0.02	0.000	3631	3.75	0.02	0.000	2225	4.19	0.02	0.000
14–15	6782	4.12	0.01		5944	3.56	0.02		4477	3.96	0.02	
16–17	2096	4.12	0.03		1881	3.47	0.03		1602	3.81	0.03	
Gender												
Male	6877	4.05	0.01	0.000	5879	3.51	0.02	0.000	4234	3.91	0.02	0.000
Female	6543	4.13	0.02		5577	3.71	0.02		4070	4.08	0.02	
Race/ethnicity												
Non-hispanic white	6500	4.20	0.01	0.000	5737	3.63	0.02	0.007	4203	4.01	0.02	0.303
Hispanic	3850	3.92	0.02		3147	3.55	0.02		2094	3.96	0.03	
Black	1840	3.96	0.03		1526	3.56	0.03		1256	3.94	0.04	
Other non-hispanic	1230	4.06	0.04		1046	3.66	0.04		751	4.00	0.05	

	Pipe[a]				Hookah				Smokeless			
	n	mean	se	p	n	mean	se	p	n	mean	se	p
Harm perception	11,376	2.5	0.01		7518	2.22	0.01		9226	2.49	0.01	
Age												
12–13	3658	2.56	0.01	0.000	1671	2.35	0.01	0.000	2640	2.47	0.01	0.000
14–15	5884	2.48	0.01		4249	2.21	0.01		4977	2.50	0.01	
16–17	1834	2.46	0.02		1598	2.14	0.01		1609	2.52	0.01	
Gender												
Male	5794	2.48	0.01	0.000	3622	2.24	0.01	0.005	4732	2.48	0.01	0.000
Female	5582	2.52	0.01		3896	2.21	0.01		4494	2.51	0.01	
Race/ethnicity												
Non-hispanic white	5897	2.49	0.01	0.014	3475	2.23	0.01	0.091	5201	2.48	0.01	0.005
Hispanic	3011	2.52	0.01		2346	2.21	0.01		2142	2.52	0.01	
Black	1395	2.50	0.02		972	2.21	0.02		1002	2.50	0.02	
Other non-hispanic	1073	2.56	0.02		725	2.27	0.02		881	2.54	0.02	
Addictiveness perception	11,020	4.07	0.01		7888	3.72	0.02		9695	4.33	0.01	
Age												
12–13	3513	4.12	0.02	0.001	1816	4.00	0.03	0.000	2902	4.34	0.02	0.502
14–15	5716	4.07	0.01		4425	3.69	0.02		5145	4.32	0.01	
16–17	1791	4.00	0.02		1647	3.49	0.04		1648	4.33	0.02	
Gender												
Male	5595	4.00	0.02	0.000	3839	3.67	0.02	0.002	4965	4.27	0.01	0.000
Female	5425	4.15	0.02		4049	3.76	0.02		4730	4.39	0.01	
Race/ethnicity												
Non-hispanic white	5685	4.12	0.02	0.000	3641	3.70	0.02	0.521	5455	4.37	0.01	0.000
Hispanic	2941	4.03	0.02		2457	3.71	0.03		2251	4.23	0.02	
Black	1363	3.97	0.03		1026	3.77	0.04		1067	4.22	0.03	
Other non-hispanic[b]	1031	4.04	0.03		764	3.73	0.04		922	4.35	0.03	

Note: Statistical evaluations (*p*-values) reflect overall group differences in weighted linear regression models. Pair-wise comparisons are used with age 12–13, males, and Non-Hispanic White as reference groups for age, gender, race/ethnicity.

[a] Indicates use of single-item assessment of harm perceptions.

[b] Indicates significant pairwise comparisons.

n = 431, 3.2%), e-cigarettes only users (n = 309, 2.3%), other non-combustible product only users (smokeless, snus, or multiple non-combustible products; n = 129, 1.0%), or poly-tobacco product users (both cigarette and non-cigarette; n = 1377, 10.2%). Among poly-tobacco users, e-cigarette use was most common (70.7%).

3.2. Harm and addictiveness perceptions by age, gender, racial/ethnic group

Table 1 shows the average perceptions of harm (range 1–3) and addictiveness (range 1–5) for each product within age, gender, and racial ethnic status groups. On average, youth rated products highly on

the global harm perception item ($M_{cigarettes}$ = 2.79, se = 0.01; M_{pipes} = 2.50, se = 0.01) and the three-item harm perception index ($M_{e\text{-}cigarettes}$ = 1.95, se = 0.01; M_{cigars} = 2.47, se = 0.01; M_{hookah} = 2.22, se = 0.01; $M_{smokeless\ tobacco}$ = 2.49, se = 0.01). Similar patterns were observed with perceptions of the addictiveness of each product, with cigarettes (M = 4.09, se = 0.01), e-cigarettes (M = 3.60, se = 0.01), cigars (M = 3.99, se = 0.02), pipe (M = 4.07, se = 0.01), hookah (M = 3.72, se = 0.02), and smokeless tobacco (M = 4.33; se = 0.01) in the range of 'somewhat' to 'very likely' addictive, on average.

Perceived harm and addictiveness of nearly all examined tobacco products differed significantly across age groups (Table 1). Compared to younger youth (12–13 year-olds), older youth (14–15 and 16–17 year-olds) perceived all products except for smokeless tobacco as less harmful (p's < 0.01), and perceived e-cigarettes, cigars, pipe, and hookah as less addictive (p's < 0.01). In contrast, older youth perceived smokeless tobacco as more harmful than did younger youth (p < 0.001), and perceived cigarettes as more addictive than did younger youth. Perceptions of addictiveness from smokeless tobacco were not significantly different across age groups (p = 0.50).

Compared to males, females rated all products as more addictive (p's < 0.01) and, with the exception of cigars and hookah, as slightly more harmful (p's < 0.01; Table 1). Differences in perceived harm and addictiveness were also observed across ethnic/racial groups, with the exception of perceived harm of cigarettes and perceived addictiveness of cigars and hookah (p's ≤ 0.01; Table 1).

3.3. Patterns of harm and addictiveness perceptions across tobacco products

Survey weighted regression models tested whether harm and addictiveness perceptions differed across products (See Table 1). When we compared perceptions of harm from cigars, e-cigarettes, hookah, and smokeless products, we found significant differences in mean ratings across products ($F(3,96) = 2930.83$, $p < 0.001$).[3] Follow-up comparisons, found that, when compared to smokeless products, cigars (mean difference = −0.02, se = 0.01, $p < 0.01$), hookah (mean difference = −0.27, se = 0.01, $p < 0.01$), and e-cigarettes (mean difference = −0.54, se = 01, $p < 0.01$) each had significantly lower harm perception ratings.

Perceived addictiveness also differed significantly across products ($F(5,94) = 682.48$, $p < 0.001$). Compared to cigarettes (mean = 4.09, se = 0.01), e-cigarettes (mean difference = −0.49, se = 0.01, $p < 0.01$), cigars (mean difference = −0.10, se = 0.01, $p < 0.01$), and hookah (mean difference = −0.37, se = 0.01, $p < 0.01$) were each rated as less addictive. Smokeless products were rated as more addictive than cigarettes (mean difference = 0.24, se = 0.01, $p < 0.001$), and pipes were rated similarly to cigarettes (mean difference = −0.02, se = 0.01, $p \geq 0.05$).

3.4. Levels of risk for tobacco product use and product harm/addictiveness perceptions

When compared to committed never users, youth classified as susceptible to use, ever/lifetime users, and current users demonstrated consistently lower levels of perceived harm across products (p's < 0.05; see Table 2). Moreover, for each of the non-cigarette products, susceptible youth and those who had ever used each product had lower perceived addictiveness when compared to committed never users (p's < 0.05). For cigarettes, youth who had ever tried cigarettes or smoked cigarettes in the past 30 days had lower perceived addictiveness than committed never users (p < 0.05), but perceived addictiveness among susceptible youth was not statistically significant from that among committed never users (see Fig. 1).

3.5. Perceptions of product harm/addictiveness by type of tobacco user

Table 2 lists results from multivariable regression models with adjustment for planned covariates comparing tobacco product user groups' perceptions of harm and addictiveness. Youth who were tobacco product users tended to perceive tobacco products as significantly less harmful and less addictive (p's < 0.05) than youth classified as committed never tobacco users, with a few exceptions. For products other than cigarettes and smokeless, this was particularly evident in users' perceptions of the addictiveness of their own products, which they tended to perceive as less addictive relative to never users. Among cigarette smokers (i.e., cigarette only and poly-tobacco users who smoked cigarettes) and smokeless users, perceived addictiveness of their own products remained high and was similar to that of never users: While cigarette smokers' perceived addictiveness of cigarettes differed from that of never users by −0.13, analogous differences were − 0.66 for e-cigarette only users' perceived addictiveness of e-cigarettes and − 0.79 and − 0.43 for non-cigarette combustible product users' perceived addictiveness of hookah and cigars, respectively.

For e-cigarette products, the lowest perceptions of harm and addictiveness were among e-cigarette only users, poly-tobacco users, and users of other non-combustible products compared to never user groups (p's < 0.01). Perceived harm and addictiveness of cigar and pipe products were lowest among poly-tobacco users and youth using non-cigarette combustible products. Perceived harm and addictiveness of hookah use were also lower among poly-tobacco users, non-cigarette combustible product users, and e-cigarette only users than other user groups. We observed significantly lower harm perceptions of smokeless tobacco products among other non-combustible product users, but relatively small differences in other user groups when comparing tobacco users to never tobacco users. Ratings of the addictiveness of smokeless products was lowest among poly-tobacco users.

No significant differences emerged in perceptions of harm and addictiveness of hookah when comparing cigarette only and never tobacco users. In addition, no differences emerged in harm perceptions of smokeless products between cigarette only and never tobacco users.

4. Discussion

Population estimates of U.S. youth perceptions of harm and addictiveness from tobacco products showed cross-product differences, age- and sex-related associations, and links to tobacco product use behaviors and susceptibility to future use. Higher perceived harm and addictiveness of cigarettes, e-cigarettes, pipe, hookah, and smokeless tobacco products were negatively associated with susceptibility and use of these products.

Our nationally representative results are consistent with previous studies in which youth appear to endorse a gradient of product harm and addictiveness (Ambrose, Rostron, Johnson, et al., 2014), with hookah (Eissenberg, Ward, Smith-Simone, et al., 2008; Maziak, Ward, & Eissenberg, 2007; Ward, Eissenberg, Gray, et al., 2007) and e-cigarettes (Amrock, Zakhar, Zhou, et al., 2014; Dutra & Glantz, 2014; Pearson et al., 2012) rated significantly less harmful than cigarettes. We extended these results using a U.S. national sample of youth aged 12–17 years-old and a broadened examination of perceived harm and addictiveness of these products. How these perceptions may be influencing poly-use patterns, such as rising rates of dual use of cigarettes and e-cigarettes (Dutra & Glantz, 2014), is worth future attention. We observed significant associations between patterns of use with different tobacco products and perceptions of harm and addictiveness. Although poly-tobacco product users tended to rate each product as less harmful and less addictive than did never users, single product users' view of the harm and addictiveness of tobacco depended on whether they had used

[3] Cigarettes and pipes were excluded from this analysis because they were assessed using the single global harm perception item rather than the three-item index.

Table 2
Multivariable regression analyses of harm and addictiveness perceptions for each product across levels of susceptibility and across users and non-users of each tobacco product.

	Cigarettes (n = 13,620)			*E*-Cigarettes (n = 12,178)			Cigars (*n* = 11,875)		
	Estimate	Std. Error	Pr(> |t|)	Estimate	Std. Error	Pr(> |t|)	Estimate	Std. Error	Pr(> |t|)
Tobacco product susceptibility and use									
Harm perceptions									
Never smoker (reference)	–	–	–	–	–	–	–	–	–
Susceptible	−0.14	0.01	0.000	−0.34	0.01	0.000	−0.22	0.01	0.000
Ever tried: Not Past 30d	−0.17	0.02	0.000	−0.45	0.02	0.000	−0.23	0.02	0.000
Ever tried: Used Past 30d	−0.44	0.03	0.000	−0.64	0.02	0.000	−0.32	0.03	0.000
Addictiveness									
Never smoker (reference)	–	–	–	–	–	–	–	–	–
Susceptible	−0.01	0.03	0.783	−0.36	0.02	0.000	−0.40	0.03	0.000
Ever tried: Not Past 30d	−0.13	0.03	0.000	−0.84	0.05	0.000	−0.70	0.05	0.000
Ever tried: Used Past 30d	−0.18	0.05	0.000	−1.15	0.07	0.000	−0.81	0.07	0.000
Tobacco product user group									
Harm perceptions									
Never tobacco user (reference)	–	–	–	–	–	–	–	–	–
Cigarette only	−0.17	−4.82	0.000	−0.13	0.03	0.000	−0.11	0.04	0.015
Poly-tobacco user: Cigarette + Other Product(s)	−0.26	−14.41	0.000	−0.35	0.02	0.000	−0.27	0.02	0.000
E-cigarettes only	−0.09	−2.82	0.006	−0.42	0.03	0.000	−0.16	0.06	0.008
Other non-combustible	−0.06	−1.42	0.159	−0.20	0.04	0.000	−0.03	0.06	0.635
Non-cigarette combustible product user	−0.04	−1.39	0.167	−0.10	0.03	0.004	−0.30	0.04	0.000
Addictiveness									
Never tobacco user (reference)	–	–	–	–	–	–	–	–	–
Cigarette only	−0.13	0.05	0.013	−0.33	0.06	0.000	−0.28	0.06	0.000
Poly-tobacco user: Cigarette + Other Product(s)	−0.15	0.04	0.000	−0.81	0.04	0.000	−0.60	0.04	0.000
E-cigarettes only	−0.04	0.07	0.598	−0.66	0.07	0.000	−0.30	0.10	0.002
Other/Multiple non-combustible	−0.02	0.11	0.834	−0.26	0.11	0.028	0.20	0.08	0.016
Non-cigarette combustible product user	0.02	0.06	0.692	−0.23	0.06	0.000	−0.43	0.06	0.000

	Pipe (n = 11,613)			Hookah (*n* = 8362)			Smokeless (n = 10,123)		
	Estimate	Std. Error	Pr(> |t|)	Estimate	Std. Error	Pr(> |t|)	Estimate	Std. Error	Pr(> |t|)
Tobacco product susceptibility and use									
Harm perceptions									
Never smoker (reference)	–	–	–	–	–	–	–	–	–
Susceptible	−0.35	0.02	0.000	−0.33	0.01	0.000	−0.23	0.02	0.000
Ever tried: Not Past 30d	−0.39	0.05	0.000	−0.42	0.02	0.000	−0.18	0.02	0.000
Ever tried: Used Past 30d	−0.66	0.13	0.000	−0.53	0.04	0.000	−0.54	0.04	0.000
Addictiveness									
Never smoker (reference)	–	–	–	–	–	–	–	–	–
Susceptible	−0.36	0.03	0.000	−0.62	0.03	0.000	−0.32	0.03	0.000
Ever tried: Not Past 30d	−0.60	0.09	0.000	−1.09	0.06	0.000	−0.35	0.07	0.000
Ever Tried: Used Past 30d	−0.95	0.22	0.000	−1.32	0.09	0.000	−0.47	0.09	0.000
Tobacco product user group									
Harm perceptions									
Never tobacco user (reference)	–	–	–	–	–	–	–	–	–
Cigarette only	−0.16	0.03	0.000	0.00	0.03	0.908	−0.01	0.02	0.733
Poly-tobacco user: Cigarette + Other Product(s)	−0.21	0.02	0.000	−0.16	0.02	0.000	−0.08	0.01	0.000
E-cigarettes only	−0.19	0.04	0.000	−0.18	0.04	0.000	0.00	0.03	0.863
Other non-combustible	0.03	0.07	0.702	−0.07	0.07	0.265	−0.28	0.05	0.000
Non-cigarette combustible product user	−0.20	0.04	0.000	−0.32	0.03	0.000	−0.07	0.03	0.009
Addictiveness									
Never tobacco user (reference)	–	–	–	–	–	–	–	–	–
Cigarette only	−0.21	0.04	0.000	−0.12	0.07	0.103	−0.12	0.06	0.028
Poly-tobacco user: Cigarette + Other Product(s)	−0.41	0.04	0.000	−0.66	0.05	0.000	−0.25	0.04	0.000
E-cigarettes only	−0.20	0.06	0.001	−0.37	0.09	0.000	−0.08	0.07	0.251
Other/multiple non-combustible	0.06	0.09	0.477	0.00	0.15	0.987	−0.21	0.12	0.072
Non-cigarette combustible product user	−0.25	0.06	0.000	−0.79	0.07	0.000	−0.16	0.06	0.006

Note: All models include adjustments for age, gender, race/ethnicity; text in red indicates a significant value ($p < 0.05$). Susceptibility = Youth who reported other than the strongest negative response to each of the three questions regard-ing tobacco product use. Poly-tobacco User: Cigarette + Other Products(s) = Youth who reported use of cigarettes AND other tobacco products. Other Non-Combustible User = Youth who reported use of smokeless, snus, or multiple non-combustible product use. Non-Cigarette Combustible Product User = Youth who reported use of cigars, pipe, and/or hookah only or multiple non-cigarette combustible product use.

cigarette, non-cigarette combustible, e-cigarette, or non-combustible products. Differences in perceptions of harm and addictiveness by use status may reflect the influence of perceptions on behavior (e.g., high perceived harm and addictiveness may discourage trial), the influence of behavior on perceptions (e.g., trial may stimulate users to reappraise and lower their perceived harm and addictiveness), or both. Interestingly, cigarette only smokers appeared similar to never tobacco users in ratings of the harm and addictiveness of hookah and smokeless

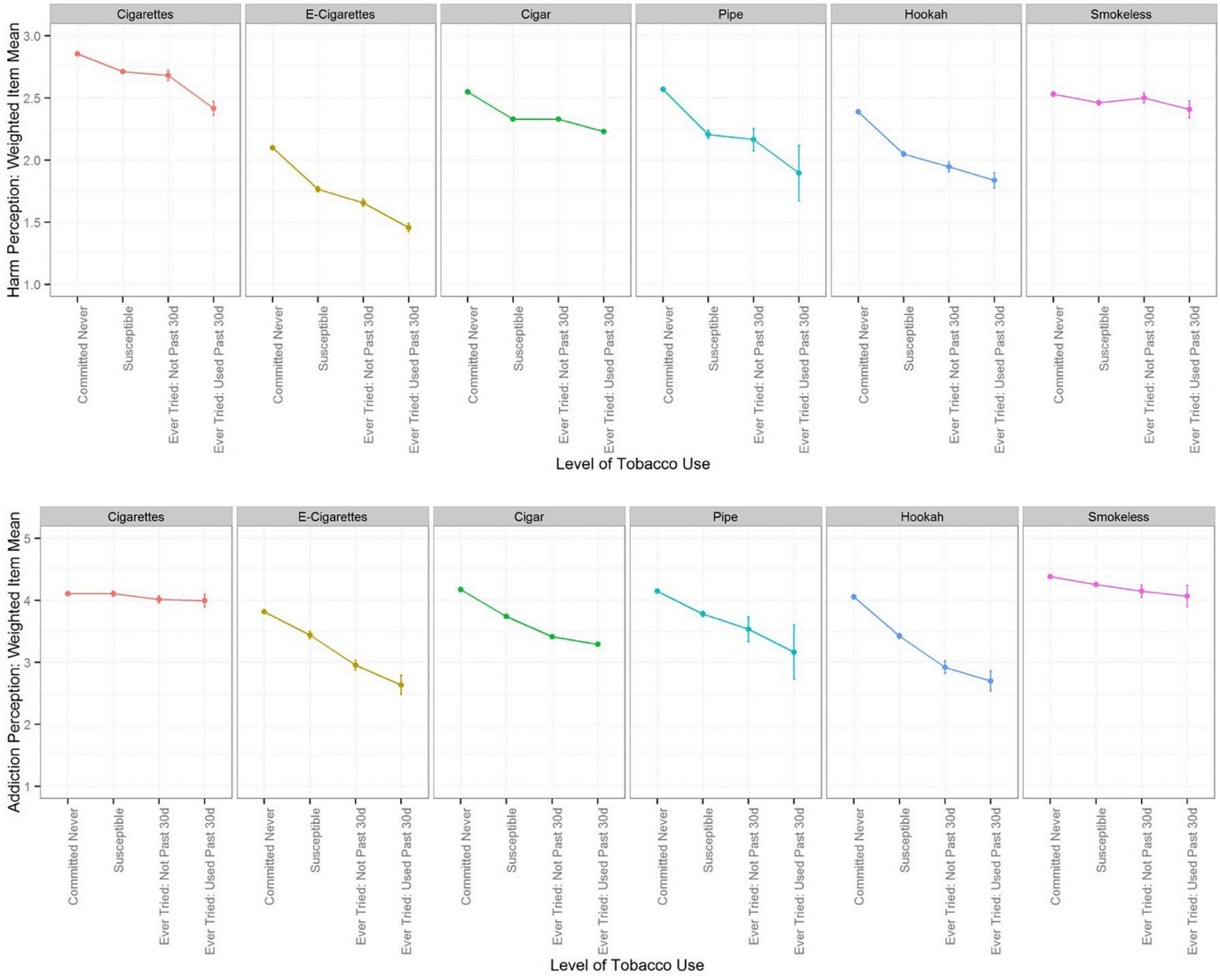

Fig. 1. Perceptions of harm and addictiveness of tobacco products by level of risk for tobacco use.
Note: Weighted average item scores reflect scores on summed indices for the harm scale and addictiveness indices. Psychometrics supported an average composite score of harm perceptions for all products except cigarettes and pipe, which used the first question only.

products, whereas hookah and smokeless users rated their products as having lower harm and addictiveness than never tobacco users. These associations suggest the potential product-specific, reciprocal influences between product perceptions and interactions with the product.

Perceptions of harm and addictiveness of products may best be characterized on a continuum, with youth who perceived gradations in levels of harm at higher risk for tobacco use initiation.[16] In theory, developing curiosity about products may generate reappraisal and lowering of harm perceptions which in turn promotes susceptibility to use. Progressing to experimentation may motivate further re-appraisals and further lowering of harm and addictiveness perceptions. These data were consistent with both the hypothesis that lowering of harm perceptions may influence susceptibility to tobacco use and the hypothesis that experiencing the biologically rewarding effects of tobacco product use may promote lowering of harm perceptions as youth progress beyond experimentation. The concurrent assessment harm and addictiveness perceptions among youth with different levels of risk for tobacco use cannot inform whether perceptions influence risk for use or if youth with greater risk for use also have lower perceptions of harm and addictiveness. Longitudinal evaluation of the development of harm perceptions and addictiveness perceptions may provide better insight into the influence of these cognitions in promoting tobacco use initiation and progression. Our findings highlight the importance of harm perceptions for health communications, public health messaging campaigns, and clinical communications for youth that include non-cigarette products and not a focus on cigarettes alone (Kaufman, Suls, & Klein, 2016).

This nationally representative U.S. sample provided summary information about perceptions of harm and addictiveness for tobacco products across key sociodemographic groups, product use susceptibility, and current and prior product use status. However, cross-sectional data cannot determine temporal relationships between risk perceptions and initiation or maintenance of tobacco product use. Subsequent waves of the PATH Study may reveal the extent to which low perceived harm and addictiveness of tobacco products predispose U.S. youth to tobacco use, rather than the reverse. Development of multi-item instruments to assess perceptions of harm and addictiveness could increase confidence in the reliability of measurement and advance movement towards a standard for cross-product comparisons (Kaufman, Suls, & Klein, 2016).

5. Conclusions

Lower perceptions of harm and addictiveness of tobacco products were associated with higher risk for tobacco product use among U.S. youth. A better understanding of longitudinal associations between perceptions and tobacco product features and use patterns among current users, as well as the potential for increased initiation of tobacco use among youth, may inform the assessment of product impact on public health.

Funding Source

This manuscript is supported with Federal funds from the National Institute on Drug Abuse, National Institutes of Health, and the Center for Tobacco Products, Food and Drug Administration, Department of Health and Human Services, under a contract to Westat (Contract No. HHSN271201100027C). No financial disclosures were reported by the authors of this paper.

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